Int J Life Cycle Assess (2008) 13:605–608
DOI 10.1007/s11367-008-0029-5

The collaboration between Int J Life Cycle Assess and J LCA Jpn

Yasunari Matsuno · Yasushi Kondo

Received: 9 May 2008 / Accepted: 12 August 2008 / Published online: 3 September 2008

1 Preamble

The Institute of Life Cycle Assessment, Japan (ILCAJ) was established in October 2004. The goal of ILCAJ is to promote academic activities related to life-cycle thinking and to share expert knowledge with colleagues from wide-ranging backgrounds. Professor Ryoichi Yamamoto, University of Tokyo, has taken responsibility as Chairman of ILCAJ.

In April 2005, ILCAJ has successfully established its publication organ (in Japanese), The Journal of Life Cycle Assessment, Japan (J LCA Jpn). The issues appear every 3 months. J LCA Jpn publishes peer-reviewed research articles, commentaries and discussions, (technical) reports, lecture notes, and presentations of research groups in Japan, among others. In Int J Life Cycle Assess 12(6):348−350, we were happy to announce the collaboration with J LCA Jpn for the purpose of exchanging knowledge, new insights, experiences, and information across the different languages.

The Corner: JLCA Jpn aims to be a bridge between the LCA community of Japan and that of the whole world. All abstracts of research articles, as well as commentaries and discussions, published in J LCA Jpn will simultaneously appear in *Int J Life Cycle Assess, Corner: JLCA Jpn*, in order to introduce Japanese activities to our readers. In addition, some selected research papers from J LCA Jpn will be submitted to Int J Life Cycle Assess for publication following peer review. We hope that this collaboration will stimulate the global exchange of information through professional pathways. The following abstracts were published in J LCA Jpn Vol. 4, No. 2.

Reponsible editors: Yasunari Matsuno, Yasushi Kondo

Y. Matsuno (✉)
Department of Materials Engineering,
Graduate School of Engineering, University of Tokyo,
7-3-1 Hongo, Bunkyo-ku,
113-8656 Tokyo, Japan
e-mail: matsuno@material.t.u-tokyo.ac.jp

Y. Kondo
Faculty of Political Science and Economics, Waseda University,
1-6-1 Nishi-waseda Shinjuku-ku,
169-8050 Tokyo, Japan
e-mail: ykondo@waseda.jp

2 Commentaries and discussions

2.1 Is organic farming environmentally superior? What agricultural LCA reveals

Kiyotada Hayashi
National Agriculture and Food Research Organization, 3-1-1 Kannondai, Tsukuba, Ibaraki 305-8666

Many studies have been conducted for assessing the environmental impacts of organic agriculture. In general, they compare a few agricultural systems including organic and conventional production. The comparison, however, raises several issues to be clarified from system thinking based on life cycle assessment (LCA). Therefore, this paper reviews applications of LCA to agriculture and presents the state of the art and some difficulties in the current studies. After surveying previous research projects and international conferences on agricultural LCA, applications of LCA to field crop production and horticulture are surveyed. Since the survey reveals the importance of utilizing multiple impact categories due to the existence of trade-offs between, for example, global warming and eutrophication, the relationship between environmental impacts of organic agriculture and impact categories in agricultural LCA is

examined using previous LCAs of wheat, in which data are gathered from field experiments. In addition, the problem with the selection of functional units is discussed because of the dependence of the results on the selection. The problem brings up a question concerning how to cope with land in agricultural LCA and, thus, biodiversity and soil quality in agricultural LCA are reviewed. Finally, future research directions are presented for the development of agricultural LCA in Japan.

2.2 LCA in animal production systems

Akifumi Ogino

NARO, National Institute of Livestock and Grassland Science, 2 Ikenodai Tsukuba Ibaraki, 305-0901

The life cycle assessment (LCA) method, which evaluates the environmental impacts associated with a product, process, or activity during its life cycle by describing its requirements for resource and the emissions, is expected to be highly effective for comprehensive environmental evaluations. An increasing environmental consciousness in society requires action by the animal industry on environmental problems, and evaluation of whole animal production systems from various environmental viewpoints has been required to reduce environmental impacts of animal production systems. Thus, studies about the evaluation of using LCA and the development of evaluation methods based on the LCA concept for animal production systems have been conducted in recent years. In this paper, we reviewed LCA studies on animal production reported and, furthermore, presented the studies that evaluated beef production and feeds prepared from food residues as examples of our research about environmental impact evaluation of animal production systems. Finally, we described challenges and future works in the research area of LCA for animal production.

2.3 LCA research on marine products

Kazuhito Watanabe[1], Kiyotaka Tahara[2] and Teisuke Miura[3]

[1]Miyagi Prefectural Government, 3-8-1 Honcho Aoba-ward Sendai-city 980-8570

[2]National Institute of Advanced Industrial Science and Technology (AIST), 16-1 Onogawa Tsukuba-city 305-8569

[3]Hokkaido University, 3-1-1 Minatocho Hakodate-city 041-0821

It is indispensable to incorporate environmental evaluation into the fishery industry in order to achieve "sustainable production and consumption." Life cycle assessment (LCA) is an important and useful tool for evaluating the environmental effects and potential impacts associated with a product and a service throughout its life span. To date, several data have been reported concerning the application of LCA to the fishery industry. Therefore, in this paper, we reviewed these reports so as to expand our knowledge and to develop LCA methodology. Moreover, we mentioned the perspective and the next challenge.

2.4 Introduction of Food Study Group, The Institute of Life Cycle Assessment, Japan

Toshisuke OZAWA[1] and 1, 2 Atsushi INABA[2]

[1]Research Center for Life Cycle Assessment, National Institute for Advanced Industrial Science and Technology, 16-1 Onogawa, Tsukuba-shi, Ibaraki-ken 305-8569

[2]Research into Artifacts, Center for Engineering, The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa-shi, Chiba-ken 277-8568

The Food Study Group (FSG), a voluntary-based study group in The Institute of Life Cycle Assessment, Japan, has carried out research and surveys since 2004 to identify the possible directions to sustainable food consumption and production. The members of FSG are from academia, national research institutes, private research institutes, and private food enterprises. FSG primarily had two tasks: (1) life cycle inventory analysis on food products and meals and (2) determining food values to develop a sustainability indicator for agro-food consumption and production. For the first task, FSG evaluated lifecycle CO_2 emission for various agro-food products including grains, meat, and vegetables, and for five different meals that consist of those products as ingredients. A hybrid approach of process LCA and I-O analysis was adopted. The result suggested that the CO_2 emissions per kilogram-product for high-protein products (meat, dairy, and fish) tend to be high, followed by high carbohydrate products (rice and wheat). With regard to cooking, boiling and steaming tend to emit more CO_2 than stir-frying and deep-frying due to their longer cooking time. For the second task, FSG adopted the concept of ecoefficiency, which is evaluated by comparing a product's service value concerning its environmental loads. We decided to take life cycle CO_2 emission as a representative to environmental load. For product value, we discussed the definition, criteria, and method to quantify the value of a meal. Further research is underway to improve the method by adopting weighting via consumer survey and aggregation to a single index.

2.5 LCA on biomass energy use

Takashi Inoue

Mitsubishi Research Institute, 2-3-6, Otemachi, Chiyoda-ku, Tokyo, 100-8141

Utilization of various biomass resources such as energy is being promoted from the viewpoint of fossil fuel conservation and prevention of global warming. In order

to foster its further utilization, it is important to evaluate the energy and environmental burden of biomass from a lifecycle perspective, thus incorporating upstream and downstream aspects such as cultivation, collection, transformation, and use in preparing a comprehensive life cycle inventory (LCI). Indices such as energy payback ratio (EPR) and energy payback time (EPT) are frequently used for this purpose. In this paper, concepts of these indices are explained, and its application to evaluation of various bioethanol projects is conducted. Considerable differences (up to about fivefold) in EPR and EPT are found among various evaluation projects, which are attributed to setting ranges of LCI, setting of parameters, differences of background databases, and treatment of allocation among coproducts (cornstarch in the case of corn, bagasse in the case of sugarcane, and lignin in the case of cellulosic resources).

3 Research article

3.1 LCA of metal parts cleaning considering plant-specific functions and constraints

Yasunori Kikuchi and Masahiko Hirao
Department of Chemical System Engineering, The University of Tokyo, Faculty of Eng. Bldg. 5, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-8656

3.1.1 Background, aim, and scope

Cleaning processes are inevitable for product manufacture and maintenance of product functions. In ordinary metal processing, metal parts are greased to avoid possible friction and confrontation by pressing or cutting. To deal with metal parts with various materials and shapes, suitable chemicals and devices have been selected on a site-to-site basis. Almost all enterprises with cleaning processes are small- and medium-sized enterprises (SMEs) in Japan. Each process has plant-specific functions and constraints dependent on its cleaning requirement. Chloride compounds have widely been utilized as cleansing agents because of their inexpensiveness, nonflammability, and high capability for precision cleaning. Because the discharge of such chemicals has become an issue, however, many alternative agents and improved processes have been developed. Available technologies for environmentally benign processes are strongly dependent on plant-specific conditions. For the reduction in risks caused by cleaning processes, the environmental aspects of cleaning should be assessed appropriately, considering plant-specific functions and constraints. This paper aimed to analyze the difference of environmental impacts among metal cleaning processes, which are utilizing chlorinated carbon and hydrocarbon, using life cycle assessment (LCA). This analysis enabled discussions of the way to evaluate and interpret environmental impacts that originated in metal cleaning, considering plant-specific conditions. Human health impacts were quantified on the basis of the life cycle of cleansing agents.

3.1.2 Materials and methods

The inventory data of cleaning processes were acquired through field investigations of plants. The cleaning functions of investigated plants were different from each other. Functional units in LCA should be carefully defined to appropriately take into account cleaning requirements for comparisons of processes. In this paper, "daily operation" and "cleaning of unit weight of products" were adopted and compared.

3.1.3 Results

The impacts attributable to cleaning process were the largest among the processes in the life cycle of a cleansing agent. Especially photochemical oxidant creation due to emitted cleansing agent was a dominant contribution to human health impacts. Global warming, air pollution in urban areas, and toxic chemical emission had the same order of contribution. According to the evaluation results for a specific plant, several actions toward the reduction in emission volume could reduce the total human health in the life cycle of cleansing agents. Although hydrocarbons have been regarded as alternative agents reducing environmental impacts, their results were quite similar to a process using chlorinated agents with well-suitable machines under the plant-specific conditions. Changing the functional unit from "daily operation" to "cleaning of unit weight of products" revealed that some plants with small impacts during daily operation have larger human health impacts per unit weight of products than plants with large daily impacts.

3.1.4 Discussion

Because the mass of each metal part is considerably small comparing the total throughputs on site, in ordinary product LCA, the inventories associated with metal cleaning might be regarded as trivial loads and can usually be cut off. The obtained results in this paper can be regarded as the hidden impacts in such assessments. Comparing the obtained results with an existing LCA result of products including metal parts, it was revealed that metal cleaning cannot be neglected to appropriately evaluate the impacts in product LCA. If one includes cleaning processes in product LCA, the impacts due to the use of a cleansing agent would be recognized and effectively reduced through the supply

chain of products. For the sake of achieving such reductions, the cleaning requirements on a process should be defined comprehensively and quantitatively.

3.1.5 Conclusions

The human health impacts originated in metal cleaning processes were analyzed by LCA with available filed data. The existence of various plant-specific functions and constraints on metal cleaning are strongly connected to the interpretation of results and, thus, functional units and system boundaries should be defined based on them. Considering such conditions, the substitution of chemicals for cleansing agents cannot be a universal solution for all processes. Process improvements must be discussed on the basis of plant-specific conditions, including the selections of chemicals, devices, and operations being performed simultaneously.

The assessment focusing on the life cycle of process chemicals can reveal hidden impacts in ordinary product assessments, where such impacts have usually been cut off because of their small contribution to the total impacts. From the viewpoint of assembly industries, they can recognize the accurate cleaning requirements by analyzing the postprocess of metal cleaning. Enhancing the appropriateness of cleaning requirements may lead to reducing the environmental impacts caused by metal cleaning processes.

3.1.6 Recommendations and perspectives

The other aspects of metal cleaning should be evaluated by other assessment methods. Local risks that occurred around cleaning plants are recommended to be evaluated. Obviously, the economic aspect is one of the most dominant factors for decision making in SMEs.